A new Early Devonian tabulate coral from the Mount Frome Limestone, near Mudgee, New South Wales

A. J. WRIGHT and R. A. FLORY

WRIGHT, A. J., & FLORY, R. A. A new Early Devonian tabulate coral from the Mount Frome Limestone, near Mudgee, New South Wales. *Proc. Linn. Soc. N.S.W.* 104 (3), (1979) 1980:211-219.

Holacanthopora clarkei sp. nov. is described from late Early Devonian beds of the Mount Frome Limestone, near Mudgee, New South Wales, Australia. The species and genus are referred here to the Micheliniidae (Favositoidea, Tabulata). Difficulties encountered in comparing genera of this family, as a result of mode of preservation and uncertainty concerning the significance of the various growth forms, are discussed.

A. J. Wright, Department of Geology, University of Wollongong, Wollongong, Australia 2500 and R. A. Flory, Department of Geological and Physical Sciences, California State University, Chico, California 95929, U.S.A.; manuscript received 4 February 1980, accepted 23 April 1980.

INTRODUCTION

Although our appreciation of the stratigraphic value of Devonian tabulate corals has increased markedly in the last two decades, there are still major gaps in our knowledge. Large-celled forms such as that described here are a case in point.

Hill and Jell (1970) make a most valuable contribution to our knowledge of a number of problematical tabulate coral genera and families, including the large-celled forms. In particular they raise the question of characteristic favositid and syringoporoid features. This is a matter of some concern with large-celled material, and is briefly discussed below. We hope that this paper will focus attention on the evolution of at least some Middle and Late Palaeozoic tabulate corals — especially the large-celled forms similar to *Michelinia*.

MATERIAL AND STRATIGRAPHY

Holacanthopora clarkei sp. nov. is a relatively large-celled, wholly cerioid tabulate coral known only from the Mount Frome Limestone (Wright, 1966) at Mount Frome near Mudgee, New South Wales, Australia (Fig. 1). The most recent estimates of the age of this formation (Philip, 1974; Pickett, 1978), based on conodonts, indicate that the Early-Middle Devonian boundary occurs in the limestone. The boundary is probably above the highest occurrence of *H. clarkei*, which occurs in the interval 36-108m (Fig. 2) and thus appears to be wholly Early Devonian.

All six known specimens of this species are transported but only slightly abraded coralla. The stratigraphically lowest specimens (USGD 85218, AMu 60130) occur in otherwise poorly fossiliferous calcarenites (Fig. 2). Three specimens (AMu 60129, USGD 85219, AMu 60131) from an intermediate stratigraphic position (Fig. 2) occur with a varied macrofauna in a crinoidal calcarenite. The single specimen (USGD 85220) from the highest level (Fig. 2) occurs in a richly fossiliferous calcarenite.

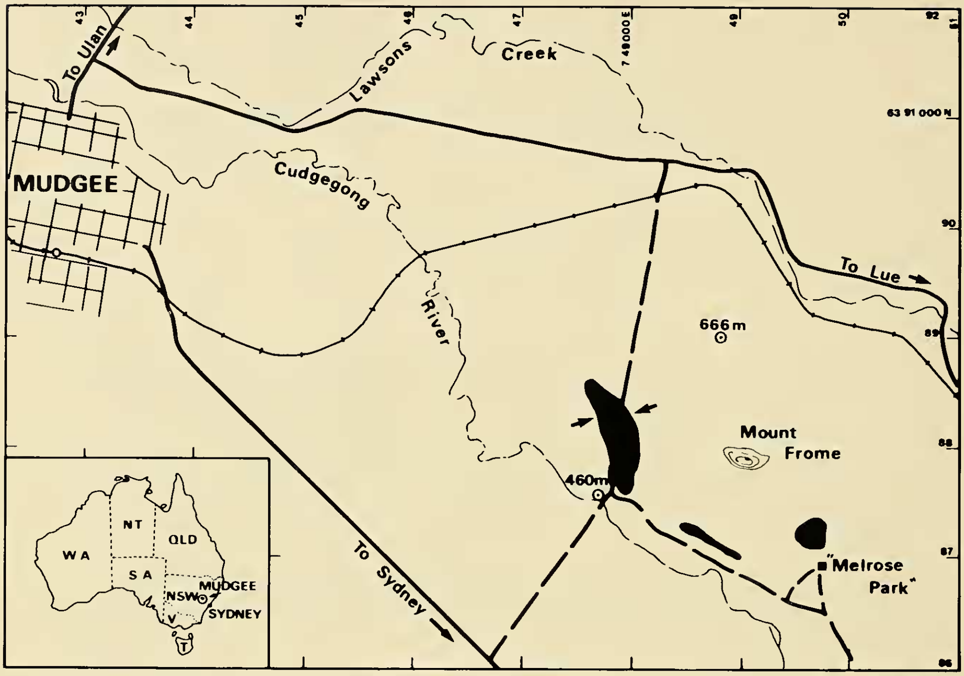

Fig. 1. Map showing main outcrops of Mount Frome Limestone. Base from Mudgee 1 : 100,000 topographic sheet 8832 (1st ed.). Grid lines 1000m intervals. Approximate location of measured section shown by arrows.

SYSTEMATIC PALAEONTOLOGY

Superfamily FAVOSITOIDEA
(*nom. transl.* Hill and Jell 1970)

Family MICHELINIIDAE Waagen and Wentzel 1886
(*nom. transl.* Sokolov 1950)

Remarks. Typified by *Michelinia,* this family is characterized by cerioid or fasciculate colonies of relatively large-celled tabulate corals with flat (or nearly so) calical floors, mural pores and usually prominent septa. The taxomic significance of acanthine septa as developed in *Holacanthopora* (but mostly not in *Michelinia* — see below) is uncertain, so Holacanthoporinae Le Maître is possibly of family status but nevertheless is provisionally considered here a junior subjective synonym of the Micheliniidae. However, the genera are retained as separate forms. Sokolov (1962) placed *Holacanthopora* in the Beaumontiinae, separate from the Micheliniinae. Hill and Jell (1970, p. 184-185) have suggested that *Pseudoroemeria* (see below), *Troedssonites* and *Syringoporinus* represent a new subfamily, possibly within the Syringoporidae. As there is some similarity between *Pseudoroemeria* and *Holacanthopora,* the new species may therefore belong in such a new subfamily. Le Maître (1959) included *Holacanthopora* and *Maurenia* in the Holacanthoporinae.

A major problem in this group of tabulate corals concerns the taxonomic significance of the growth form. This problem is aggravated by the various types of preservation. Although the two factors are intertwined, it is possible to delineate some resultant problems. Many taxa in this group are notoriously variable in growth form. For instance, *Holacanthopora,* as presently understood, includes both cerioid and

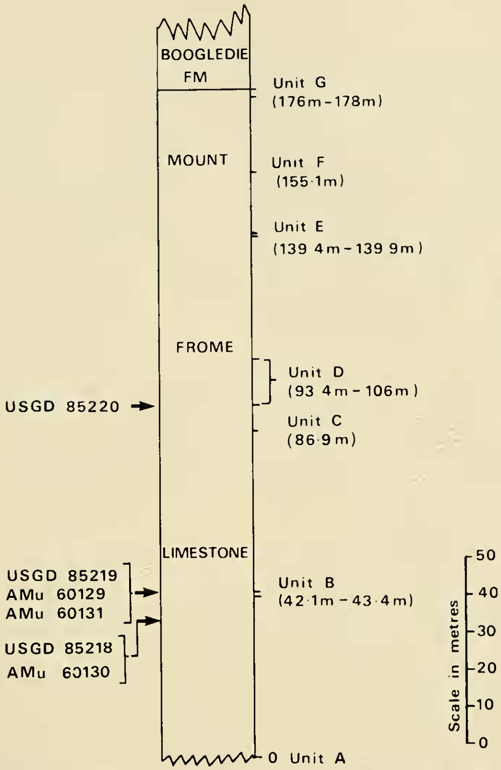

Fig. 2. Stratigraphic section through the Mount Frome Limestone showing location of specimens and informal faunal subdivisions of the Limestone.

fasciculate species which should possibly be separated on the basis of growth form at the generic level. However, it is also possible that genus-level taxa in this group ought to include a wide variety of growth forms as many species-level taxa [e.g. *P. (Pleurodictyum) cylindricum* (Michelin): Stumm, 1964, pl. 71, figs 1-5] are themselves quite variable. In particular, it is far from clear whether flattened colonies are generically distinct from more upright colonies approaching hemispherical form. Jones (1944) has discussed the problems generated by differing preservation in relation to *Michelinia* and *Pleurodictyum*. Many *Pleurodictyum*, such as are common in the Rhenish facies, occur as moulds and are discoidal colonies; these seem distinct from erect forms such as *Pleurodictyum bifidum* Jones, 1944 and many of the forms described by Stumm (1964), especially those which are many-celled colonies.

The problems created by varied preservation take on two main aspects. Firstly we have the matter of comparison of observed overall shape of the corallum; secondly there is the problem of comparison of detailed structures, often obscured by silicification and largely absent in moulds (e.g. septal microstructure). We believe these are separate problems as their results are felt at different taxonomic levels.

The problem of preservation is an acute problem exemplified by the contrast between 'typical' Rhenish *Pleurodictyum* (almost always preserved as moulds) and the abundant North American materials (e.g. Stumm, 1964) (generally calcareous or silicified). One result is considerable doubt as to the generic and subgeneric status of the *Pleurodictyum problematicum* Goldfuss (and *Pleurodictyum megastoma* McCoy) group compared with larger colonial forms such as *P. bifidum* Jones, 1944, *P. (Pleurodictyum) maximum* (Troost) and some other forms described by Stumm (1964). It may be that mould material referred to *Procteria* by Plusquellec (1965) and *Cleistopora* by Plusquellec (1966) will be eventually referred to *Pleurodictyum* when the importance of fine morphological features can be evaluated. Some unfortunate results of poor and good preservation might finally be noted. Concerning the former, the literature is replete with instances of probably indeterminate, broadly 'favositid' material preserved as moulds and referred (we believe erroneously in many cases) to *Pleurodictyum*. Conversely, well-preserved calcareous material described as a new tetracoral genus *Araiostrotion* (Guo, 1965) is probably a *Pleurodictyum* (see also Weyer, 1973).

Subfamily Holacanthoporinae Le Maître, 1957

Holacanthopora Le Maître, 1954, p. 1668

Type Species. Michelinia (Ethmoplax) fascialis Le Maître, 1952, p. 80, pl. 4, figs 3-6.

Diagnosis. Large-celled fasciculate and cerioid Tabulata with abundant acanthine septa; tabular floors weakly convex to weakly concave; mural pores located at or near wall junctions (new diagnosis).

Remarks. In addition to the type species, Le Maître (1959) also placed in this genus *H. gracilis* Le Maître, 1954 (*nom. nud.*) and *H. irregularis* Le Maître, 1957 (*nom. nud.*). The genus ranges from Emsian to Givetian (Le Maître, 1959 p. 147). *H. irregularis* is known from the Emsian (Le Maître, 1959, p. 203) and *H. fascialis* is known from the early Couvinian (Le Maître, 1952, 1954, 1959). *H. gracilis* ranges from the early Couvinian to early Givetian (Le Maître, 1959, p. 203).

Michelinia and *Holacanthopora* differ as the former lacks acanthine septa. Only in *Michelinia varia* Pickett (1967, p. 34) have '. . . very short septal spines . . .' been described, projecting into the lumen; it remains to be seen whether truly acanthine septa are widespread in European *Michelinia*.

Some similarities may be noted between *Holacanthopora* and *Pseudoroemeria* Chekhovich, 1960. The type species, *P. atbashiensis* Chekhovich, 1960, is partly cerioid and has mostly horizontal or oblique tabulae which Hill and Jell (1970, p. 185) consider favositoid. *P. pulchra* (Dubatolov, 1969, pl. X, figs 2a-b; 1971, pl. 5, figs 1a-b) has thickened walls (as in *Roemeripora*) and prominent mural pores which profoundly affect the tabulae. In this latter feature the Russian species differs markedly from the North African and Australian species.

Holacanthopora clarkei Wright & Flory, sp. nov.

Fig. 3A-F; Fig. 4A

Diagnosis. Wholly cerioid *Holacanthopora* with corallites up to 6.5 mm in diameter; up to about 10 acanthine septa on each wall; calical floors more or less horizontal, consisting of globose tabulae.

Etymology. The species is named after Rev. W. B. Clarke who was apparently the first to record the Devonian age of the limestones at Mount Frome (Clarke, 1878, p. 16),

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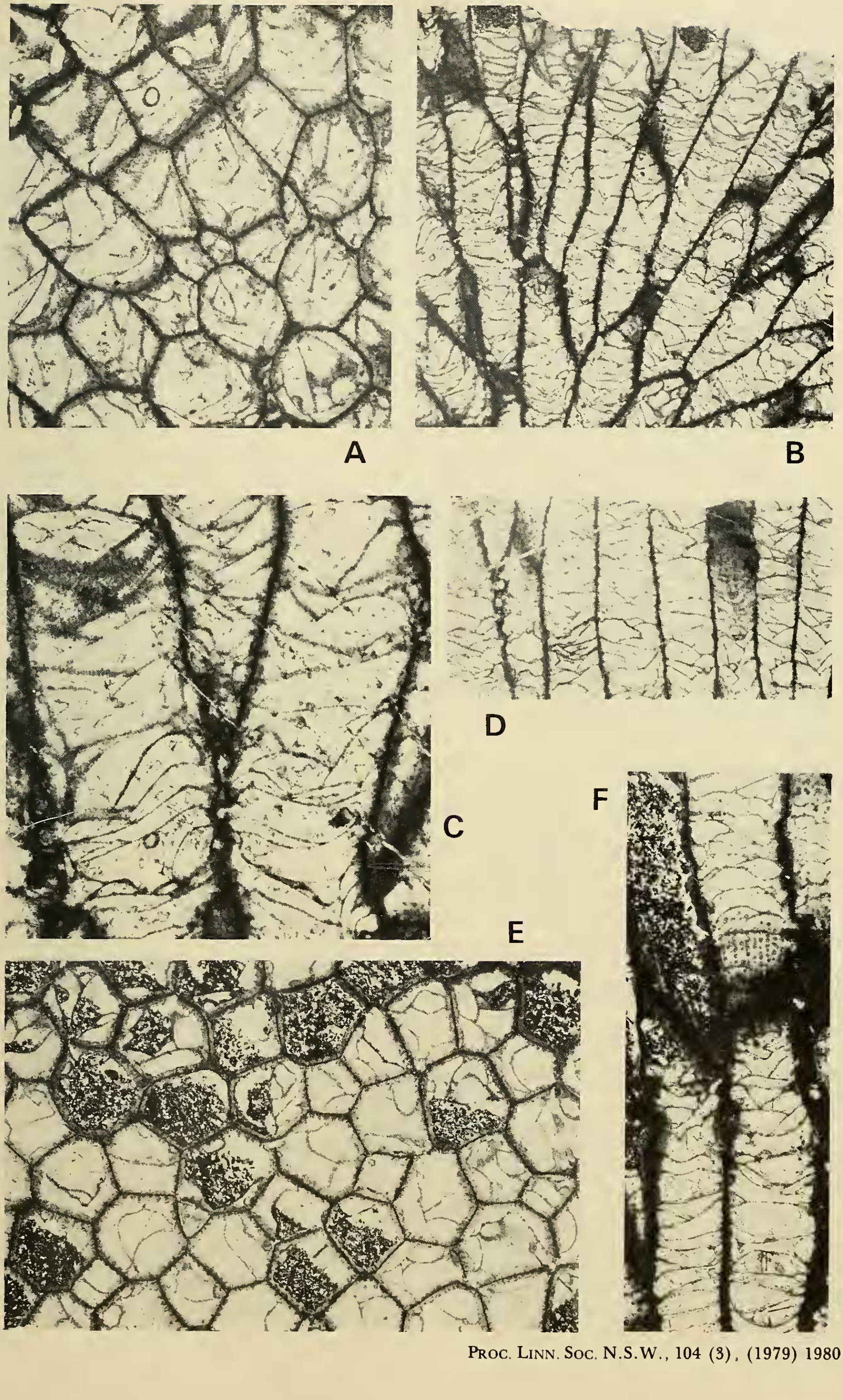
Fig. 3. Holacanthopora clarkei Wright & Flory, sp. nov. Mount Frome Limestone, Early Devonian, near Mudgee, New South Wales. **A, B, C,** holotype USGD 85218; **A,** transverse section, x2.5. **B,** longitudinal section, x1.5. **C,** longitudinal section showing mural pores, x4. **D,** AMu 60131, longitudinal section, x2. **E, F,** USGD 85219; **E,** transverse section, x2.5. **F,** longitudinal section, x3.5. Both **E** and **F** show the abundant septal spines.

Specimens bearing USGD are in the collections of the Department of Geology and Geophysics, University of Sydney; AMu denotes specimens in the Australian Museum collections.


A
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probably based on fossils (especially *Calceola*) collected by Professor A. M. Thomson (Taylor, 1879).

Material. 6 specimens, whose stratigraphic distribution is shown in Fig. 2. Holotype USGD 85218 (slides WW 190-191); paratypes USGD 85220 (slides W 220-221-222); USGD 85219 (slides W 497-498); AMu 60131 (slides WW 1-5 inclusive); AMu 60129 (slide WW 192); AMu 60130 (slides WW 193-194), all from the Mount Frome Limestone.

Description. Colony cerioid, approximately spherical and up to at least 12 cm in diameter. Even at colony rim, corallites polygonal, although walls often curved; corallites up to 6.5 mm in maximum diagonal diameter. Walls up to 0.8 mm in total thickness with thin dark median structure (presumably primary) which bifurcates in places but elsewhere has beaded, discontinuous appearance (presumably recrystallization). Stereozone contains up to 10 (usually about 7) septa on each wall. Mural pores about 0.5 mm in diameter mostly located at or near wall junctions; their vertical arrangement apparently in single series. Calices about 5 mm in depth, with subhorizontal floors. Increase intermural (Fig. 4A), at junctions of 3 or more corallites.

At inner edge, stereozone denticulate, with short (up to 1 mm in length) septa with rounded or angular axial ends in transverse section which are weakly distally concave and distally inclined at low angle. Septa contain slender holacanths set in lamellar calcite and extend to median axial structure of wall. Longitudinal sections show acanthine septa (Fig. 3F).

Tabular floors weakly convex to weakly depressed (with no sign of syrinx), formed by weakly convex to weakly concave, subhorizontal to gently inclined incomplete plates (tabellae). Spacing often up to 1 mm. Rarely septal spines on these plates.

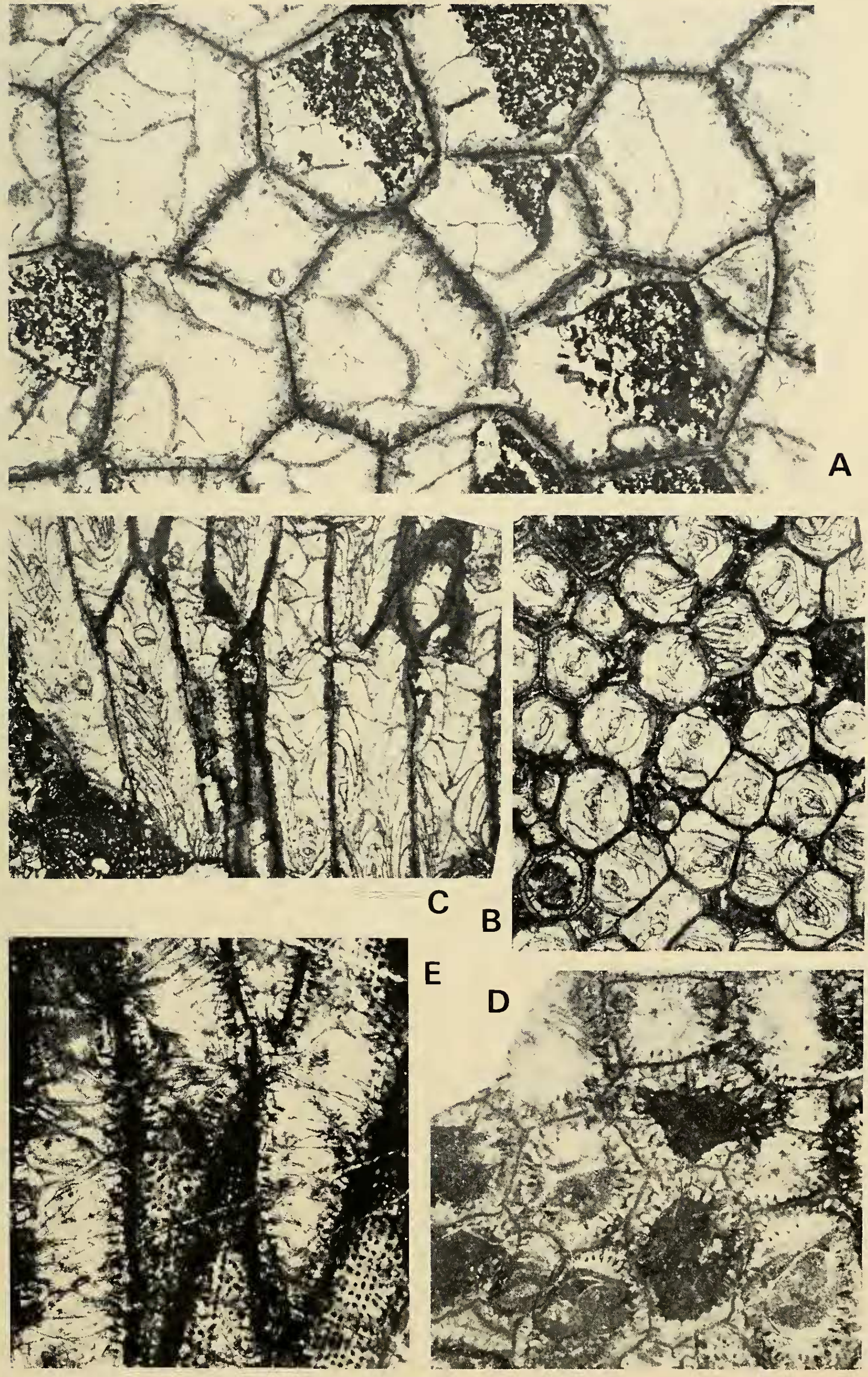
Comparisons. Le Maître (1957, 1959) assigns three species to *Holacanthopora, viz. H. fascialis* Le Maître, 1952; *H. irregularis* Le Maître, 1957 (*nom. nud.*) and *H. gracilis* Le Maître, 1954 (*nom. nud.*).

Of the three Northern Hemisphere species placed in this genus, only *H. fascialis* can be usefully compared (and then only in its size and internal morphology) with *H. clarkei.* A major difference is that, whereas *clarkei* is cerioid, *fascialis* is fasciculate (Le Maître, 1952, p. 80). In addition, corallite increase in *clarkei* is intermural but in *fascialis* is lateral. Le Maître (1957) states that *H. gracilis* and *H. irregularis* are cerioid species. In *gracilis* the colony diameter is 7 mm (Le Maître, 1954, p. 1668) and in *irregularis* the corallite diameter is 4 mm (Le Maître, 1957).

Some general similarity with *Michelinia* is evident, but *Holacanthopora* is distinguished from *Michelinia* in possessing acanthine septa (see above). Devonian tabulate corals from many parts of the world have been assigned to *Michelinia,* but these reports probably require reassessment; a noteworthy occurrence in this regard is the cerioid *M. transitoria* (Knod, 1908) from the Lower Devonian of Bolivia (Barthel and Barth, 1972). Sokolov (1962, p. 226) gives the range of the genus as Lower, Middle and Upper Devonian as well as Carboniferous.

Remarks. The only similarly large-celled cerioid tabulate coral common in earlier Devonian limestones in New South Wales is *Roemeripora progenitor* (Chapman)

Fig. 4. A, *Holacanthopora clarkei* Wright & Flory, sp. nov. Mount Frome Limestone, Early Devonian, near Mudgee, New South Wales; USGD 85219, transverse section, x6, showing wall structure, septal spines and mural pores. **B**, **C**, *Roemeripora progenitor* (Chapman), USGD 88216, Jesse Limestone, Limekilns, New South Wales, Early Devonian; **B**, transverse section, x3. **C**, longitudinal section, x3. **D**, **E**, *Pleurodictyum bifidum* Jones, holotype USGD 6251, 'Garra Beds', near Wellington, New South Wales, Early Devonian; **D**, transverse section, x5. **E**, longitudinal section, x5.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(Hill and Jell, 1970), clearly a roemeriporid (syringoporid) (Fig. 4B-C). Despite the similar wall structure, the nature of the tabulae argues against any phylogenetic relationship between *progenitor* and *clarkei.* The rare *Pleurodictyum bifidum* Jones, 1944, from New South Wales differs from *H. clarkei* in possessing distant, complete and flattish tabulae (Fig. 4D-E), but probably should be placed in *Holacanthopora* and could be ancestral to *clarkei;* both species have abundant septal spines.

ACKNOWLEDGEMENTS

This work is part of a continuing study of Devonian biostratigraphy generously supported by ARGC grants to A. J. Wright.

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